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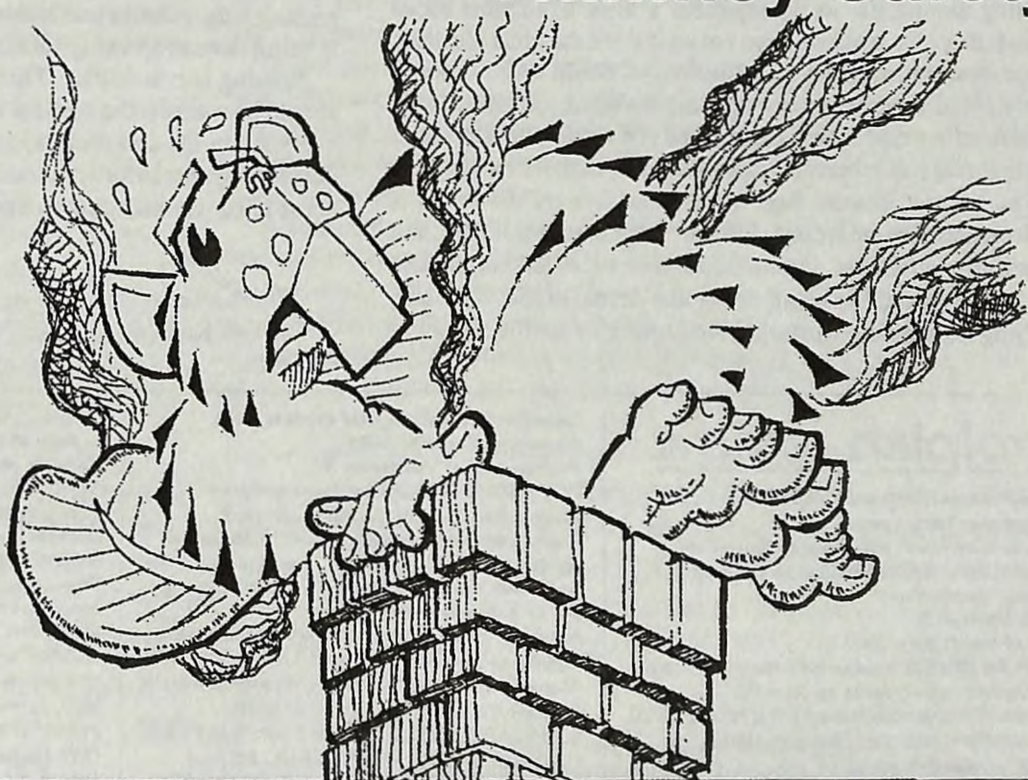

From the Editor . . .

Observing the social currents in the wind today brings to mind the old Chinese proverb that says, "May you live in interesting times." We certainly seem to be experiencing interesting events, though I am not convinced this is in our long-term interest.

While our focus is on the technical aspects of stick and brick construction, we cannot ignore broader societal issues. After all, it is these other social issues and values that help shape what and how we do our thing. In the home building industry we, quite rightly, dwell on the sticks and stones that define a house. We try to build them as well as we can to create durable, healthy, comfortable homes in which to live and raise families.

We have an image of our home as a private castle, where we can retreat from the pressures of everyday life. Yet, if we forget that our homes are not islands in splendid isolation, we do so at our peril. We are social creatures and function within a range of social networks. We can build the most beautiful house or cluster of houses, but that does not make a community.

I see new developments that come with thick books defining restrictive covenants telling you how the house must look and what materials and colours can or cannot be used. Some even go so far as saying what you can or cannot do in the backyard, and what you're allowed to plant in the garden. Interestingly, these restrictions are prepared by private developers in the name of setting a standard and maintaining property values.

On a broader scale, social and political currents presently swirling around the world represent a level of implied social engineering on a scale we have not seen since the great idealistic experiments immediately after the Second World War. Unfortunately, the ideology we are seeing today is a banal, narrow-minded accountant's world view - capable only of reading ledger sheets and ignoring any inherent social values that make life a pleasure.

The narrow, bottom line world view favours the kinds of environments we are facing. We can do our best to build the most beautiful, comfortable, durable house we are able to. Yet so much of what we do ends up being sterile and devoid of life. The only unifying community nurturing structure may be the school or community centre - at least for those with school age children. Even that is being compromised as cost cutting accountants and politicians apply industrial management models and insist on ever larger centralized schools, which involve moving kids great distances to an ever larger school, and destroying neighbourhood networks.

Suburban sprawl is easy to build, but doesn't create communities. The suburban house may be one way to provide "affordable" housing, but the price of the house ignores the cost of servicing and maintaining it and the other costs that go with living in such a sprawling environment. It creates environments where you can't even walk to the corner store because there isn't one close enough to walk to. And since everyone has to travel long distances in a private vehicle to get anywhere, there is no one at home most of the time, nor is there much opportunity to meet neighbours.

Lest you think this rant has nothing to do with what we do and how we do it, just think about the house you are building today and compare it with the house and neighbourhood you grew up in or your grandparents lived in. How many of those houses were armed camps? How many houses do you build today that do not include a full alarm system? How does spending a couple of thousand dollars on security systems add to home affordability? We've adapted and are ready to accept private security armies as normal. These things should not be needed if we have healthy communities. They are a sign that something is seriously wrong with our communities, which will not be solved merely by reading ledger sheets and cutting community infrastructure as is being done in so many jurisdictions.

Nothing is ever static. Things have to change, but change should be made in the context of a greater vision that includes everyone in the community, and not as a result of decisions cobbled together in anonymous backrooms in isolation from any sense of community participation.

Richard Kadulski,
Editor

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Chimney Safety

Proper chimney draft is one of the most important safety considerations in the operation of a combustion appliance. Flue draft is fragile, and we must understand all factors that affect it or suffer the consequences.

We used to think that the creosote smell from the family room fireplace was a normal occurrence. While at one time this might have been considered acceptable, it no longer is today. We now know that the smell is a mix of toxic compounds. Worse, the presence of this smell usually indicates a more serious problem.

Changes in construction practices have meant that our homes operate differently than in the past. In our quest for improved comfort and economy, we build better, more draft-proof homes. Sheet materials - like dry wall, plywood and OSB, gasketed electrical boxes and better sealing around wiring and plumbing penetrations are common. We try for better air sealing between the house and an attached garage to keep carbon monoxide (CO) from infiltrating the living space.

Especially in apartments, upgraded draft proofing not only improves each unit's fire and smoke protection from neighbours, it is one of the main ways to isolate the dwelling from street noise and airborne noise from next-door.

Sealing exterior wall plates can eliminate black perimeter carpet "ghosting". Draft-proofing the attic floor will stop flies from entering the house through the square holes cut for round plumbing stacks.

All these improvements lead to more airtight buildings. This can make chimneys more vulnerable to the influences of large downdraft kitchen exhaust fans, bathroom fans, and dryers as well as to the imbalances created by poorly designed or installed forced air heating systems.

To be successful today, we must not only learn about the equipment we put into houses, but also how it affects and is affected by the home into which we install it. After all, a sick or dead client is not a good referral!

A recent case of combustion gas spillage in South Eastern BC shows how easily spillage of combustion gases into a house can occur. Lethal concentrations of carbon monoxide were detected. Fortunately, the homeowner survived because the amount of spillage was mitigated by the way the house was operated, and the toxic condition was identified in time. Unfortunately, all systems in the house were code compliant, and the incident went unreported.

It is important to recognize that, while codes deal with fundamental safety issues, code compliant mechanical systems can still be unsafe for the occupant. This happens because, despite the best intentions, no code can take into account all possible design configurations of a house, or predict the way in which a home will be operated.

This all becomes clearer when we consider how a house functions, and remember that a house is a system.

Unless the venting of all combustion appliances is sealed, chimney draft will be affected by the pressure imbalances in a house.

Forced warm air systems work because the furnace fan pressurizes the ducts to push the warm air to its intended location. Air is sucked back through the return, because any pressure differential will try to equalize. Improperly sized systems and duct leakage can create regions of higher or lower pressure.

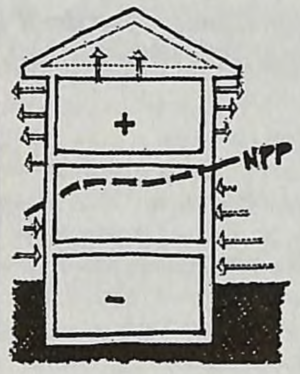
Carpet ghosting is a visual indicator that pressure differences between rooms or between indoors and outdoors exist. More importantly, pressure differences can affect flue drafts in naturally aspirating combustion appliances.

A home's design, its height, the number, type and location of exhaust fans and the heating system, especially if forced air, will affect a chimney's draft and hence a home's safety. When chimney flues are designed, their height, cross section area, straightness, insulation and operating temperature

when chimney flues are designed, their height, cross section area, straightness, insulation and operating temperature are considered. . . .it is important to recognize that the draft in a flue is affected by the chimney's location in the house - whether it is inside or outside the heated envelope

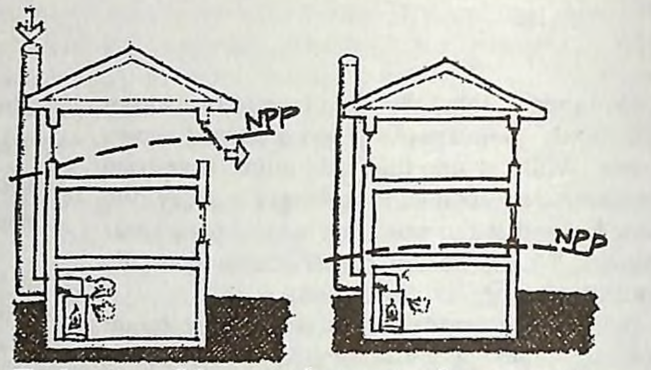
Chimney draft = chimney height x temperature difference between outside and inside, - minus house pressure, - minus resistance of chimney and fittings

Neutral Pressure Plane



The *neutral pressure plane* (NPP) is a real but invisible plane cutting across a house. Theoretically, one could cut an opening for a pet at the neutral pressure plane and not have to install a door to keep the heat in. The NPP can be thought of as a scarf blowing in the wind, its location where it cuts through the house depends on wind strength, direction, and the temperature difference between inside and outside. Below it, infiltration occurs; above it exfiltration. The NPP will be affected by and move with wind, open windows, and the use of exhaust fans.

Neutral pressure plane is affected by wind strength and temperature difference between inside and outside.



The location of the neutral pressure plane can vary. Depending on building airtightness and dynamic effects of equipment in the house, it can be low or high in the house.

Openings in the upper part of the house (air leakage from the house to the attice, open windows, exhaust fans) will tend to raise the NPP, while a tighter upper portion of the house (closed upper floor windows) tend to lower NPP.

are considered. However, it is especially important to recognize that the draft in a flue is affected by whether it is inside or outside the heated envelope of the house.

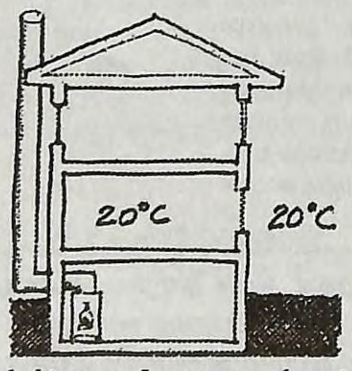
A flue on an outside wall, even when it is boxed in and insulated, should for all practical purposes be considered an exterior flue.

Every house is affected by stack action. The higher the house, and the bigger the temperature difference between inside and outside, the more pronounced the stack effect. Stack action can have a significant impact on the operation of a flue.

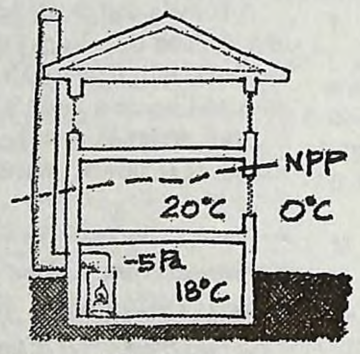
Chimneys

A chimney is a hole in the building's envelope into which we install a duct. If the duct penetrates the ceiling, we call it a warm chimney. If the duct goes out through a lower part of the house, we call it a cold chimney. Both warm and cold chimneys are identical until winter when the heat is turned on. As the outdoor temperature falls, the indoor air being heated will become lighter and begin to drift upwards and leak out through holes in the upper part of the house. The strength of this draft (stack action) increases as winter sets in. A hole penetrating the wall at a low or even mid-height location, regardless of whether it is a chimney or not, will become a make-up air source. It replaces the air that the warm chimney and/or other higher levels holes vent out.

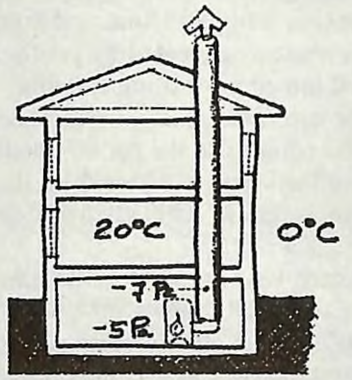
Unfortunately, the safety of an appliance at start-up and tail-out when connected to a side wall chimney penetrating at low to mid wall location is determined more by the distribution of air leakage holes than by any other factor. The location and size and total area of the leakage holes determines the location of the neutral pressure plane. If most of the holes are low, safety is increased. If they are high, safety is decreased. The use of exhaust fans only makes what is inherently poor even less safe.



Cold chimney. In summer, there is no temperature difference and no pressure difference between inside and outside, so no draft will be generated until a temperature difference develops (i.e. when the furnace or water tank starts).



Cold Chimney. Typical basement may be at -5 Pa relative to the outdoors. The chimney will be at a positive pressure compared to the basement room housing the appliance, and outside air will try to enter the house. Proper draft can't be established until full length of flue is heated to at least the interior house temperature.



In a warm chimney, the air will be at least at house temperature, warmer than outdoor air and buoyant, so will tend to rise. The lower pressure at the draft collar will enhance the draft up the flue.

Return Air Leakage

Forced air heating systems in compartmentalized two- or three-storey houses (i.e. houses divided into rooms) increase the risks. Normally, we assume that a furnace will heat the whole house without considering the home's compartmentalization. In the past we have incorrectly assumed that the furnace delivers as much air to each room as it withdraws. However, because of its relatively large fan capacity, even a small mismatch between delivered and returned volumes to/from each room will cause one room to become pressurized and its neighbour to become the opposite. These pressure imbalances are made worse by leaky ducts. Further, poorly placed exhaust fans, such as clothes dryers placed next to the furnace and hot water tank can also cause problems.

These mechanically induced pressure differences can easily dwarf building stack action and almost as easily challenge the gravity forces of a fully pre-warmed chimney. This explains why a forced air heating system, adding to the home's air leakage, is often credited with providing occupant ventilation, and also explains why the use of forced air heating can easily increase operating costs.

We will likely never be able to fully protect ourselves (without using absolutely sealed, direct vent appliances) against the negative pressures induced by customer selected large kitchen exhaust appliances. But we cannot install and service fuel burning appliances in isolation. We will always be vulnerable to start-up and tail-out spillage problems if we connect combustion appliances to cold chimneys.

We will likely never be able to protect ourselves against these same problems when furnace duct systems are undersized and poorly sealed/installed. It is important to try and foresee these problems in advance. That is what design is all about. That is also a reason why the R-2000 Standard now requires heating systems be designed and installed correctly, based on a room-by-room calculation. ☼

Best practices for wood burning fireplace installation

- ☞ *Ensure that the manufacturer's installation instructions are followed*
- ☞ *Ensure that local codes are complied with*
- ☞ *Make sure of good workmanship by installers*
- ☞ *Install fireplaces and chimneys inside the building envelope*
- ☞ *Penetrate the building envelope at or near its highest level*
- ☞ *Avoid large, uncompensated exhausts*
- ☞ *Avoid very short chimney systems*
- ☞ *Use straight chimney systems*
- ☞ *Provide glass doors*

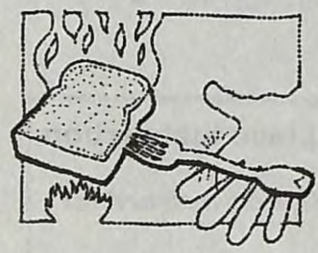
Static Pressure

- the air pressure that air exerts trying to get into or leave a duct or a house or any closed compartment
- building envelope pressure can be +, - and neutral and is caused by
  a) trying to confine warm air in a house during winter
  b) trying to prevent wind from entering the house
- duct pressure can be + or - and is caused by a fan blowing into or sucking from an air duct
- chimney draft; if the vent pressure is not negative, you get smoked out

Physics 102: The Fundamentals of Heat Flow

Heat is energy transfer due to temperature difference. Heat always flows in the direction of decreasing temperature, from warm to cold. Heat flow is directly proportional to temperature difference and inversely proportional to thermal resistance. In other words, a large temperature difference and a small R-value mean a big heat loss. A small temperature difference and a high R-value mean little heat loss.

Heat flows in three ways: through conduction, convection and radiation. In most situations, more than one mode of heat transfer is involved.



Conduction

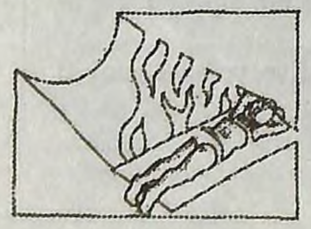
Conduction is heat transfer where heat energy moves through a solid material. Conduction is the main heat transfer mechanism in solid, opaque materials and assemblies. For most insulating materials, conduction is not the only mode of heat transfer.

Conduction is also the primary mode of heat transfer for homogeneous, dense materials. However, as the temperature increases, heat transmission by thermal radiation and convection becomes a greater part of the total heat transferred.

Convection

Convection is heat transfer through fluids and gases. Convection and air infiltration in or through some insulation systems may increase heat transfer across them. Low-density, loose fill, large open-cell and fibrous insulations, and poorly designed or installed reflective systems are most susceptible to increased heat transfer by convection. The temperature difference across an insulation, as well as the height, thickness, or width of the insulated space, influence the amount of convection.

In small and narrow spaces, convection is practically suppressed. For example, in double-glazed windows the optimum spacing is about ½" for best performance, because wider spacing between the panes allows for convection currents.



Radiation

Radiant heat transfer differs from conduction and convection in that it does not depend on an intermediate material as an energy carrier. Radiation is a function of the temperatures, radiation properties, and geometrical arrangement of the enclosure and the body in question. While in conduction and convection heat transfer takes place through matter, radiant energy is stopped by the presence of a material between the regions. There is a change in energy from internal energy at the source to electromagnetic energy for transmission, then back to internal energy at the receiver. While conduction and convection are affected mainly by the temperature difference and only somewhat by the absolute temperature, the heat transferred by radiation increases rapidly as the temperature increases.

The magnitude of radiation and convection heat transfer depends on the temperature difference, the direction of heat flow, the nature of the materials involved, and geometric considerations. The rate of radiant heat transfer varies in the proportion to the fourth power of the absolute temperature.

If two objects at different temperatures can "see" each other, they will tend toward the same temperature by radiation. An example is the feeling of cold you may experience when sitting beside a cold window at night when the inside is warm, but the outside is cold.

Radiation does not heat the air as it passes through, but heats any objects it may strike, such as a human body, floors, furnishings and walls. Examples of radiant heat transfer include: the warmth felt from sitting near a fire, being exposed to the sun, and being heated by radiant floor or ceiling heating systems.

To obtain high thermal resistance with reflective insulation, a series of multiple air layers bounded by reflective surfaces are needed. The total resistance equals the sum of the resistance values across each air space.

Condensation should be prevented from forming on a reflective surface because, apart from other effects, it degrades the surface's reflective properties. The presence of condensation or frost can also change a reflective surface enough to reduce its reflectance and increase its emittance. ☼

Physics 103: Mean Radiant Temperature

The issue of radiant energy flows is confused by the fact that the human body experiences radiant heat exchange, and it is an important aspect affecting our comfort.

Conditions of comfort vary from person to person. Our feeling of comfort is influenced by our activity level and clothing; the air temperature, air movement, humidity; and surrounding surface temperatures. A comfortable environment is one in which these factors are in an appropriate mix. The mix is complex, as a change in one factor will affect another. Understanding the subtlety of these factors goes a long way to understanding the qualities of different heating systems.

Many combinations of air temperature, surface temperature, air movement, and humidity that create comfortable conditions are possible, but all are interrelated. That is why merely maintaining a set air temperature will not always ensure comfort.

The concept of *mean radiant temperature* has been developed to define surface temperatures. Mean radiant temperature is one of the most important elements affecting comfort. It is the temperature of surfaces surrounding a person. It is also a measure of the radiant heat exchange between a person and his or her surroundings. The mean radiant temperature is dependent on the relationship of the surface to the person and can vary from point to point.

The qualities of the surrounding surfaces are also important, as these determine how good a reflector the surfaces are. With a perfect reflector, the radiant energy loss from a person is reflected back at the same temperature as the person's body, so there will be little discomfort. Of course, there is no such thing as a perfect reflector. When there are several surfaces at different temperatures, as is usually the case, the effect of the mean radiant temperature becomes more significant and can contribute to significant discomfort.

A simple formula has been developed that allows the normal comfort level of a room to be calculated by adding the two primary heating components: air temperature and mean radiant temperature (MRT). For MRT, you can substitute average room surface temperature. The formula is: air temperature (°F) + mean radiant temperature (°F) = 140 (°F).

Drapes drawn in front of large picture windows at night can improve comfort by reducing radiant heat loss because the surface of the fabric now becomes the radiant surface and the temperature of the fabric is warmer than the surface of the cold window. As a result, not as much radiant heat is lost. Similarly, low-e coatings on windows enhance conditions of comfort. ☼

Simplified formula for comfort conditions:
air temperature (°F) + mean radiant temperature (°F) = 140 (°F).

Low-Emissivity Paint: Paint that Insulates?

Fact or Fiction?

A number of paints and coatings now on the market make claims that their use gives a surface an insulating value. The basis for these claims is that the paints have a low emissivity, are reflective, or both. Is there any truth behind these claims?

Heat Transfer

Of the three modes of heat transfer - conduction, convection and radiation - emissivity has an effect only on radiation. Low-e coatings and paints work by reducing radiative heat transfer. Radiation heat transfer occurs off the surface of a material exposed to a lower temperature. On the other hand, R-values are steady-state measurements that combine all three modes of heat transfer that occur through materials.

Emissivity

Emissivity is a physical property that rates a material's ability to radiate heat. The scientific definition of emissivity is "a ratio which compares the radiating capability of a surface to that of an

perfect radiator or 'black body'." The emissivity of a "black body" is 1.0. Imperfect radiators or emitters have an emissivity of less than 1.0.

Low-e coatings and paints work by reducing radiative heat transfer. They can reduce radiant heat flow by 70 to 90%. However, they do not affect the other modes of heat transfer (conduction and convection) at all, and have limited use in modern building envelopes.

A real-life example of differences in emissivity is to compare a wood stove to a stainless steel pot. Typically, wood stoves are black, and will have an emissivity of close to 1.0, while a stainless steel pot is shiny and bright and will have an emissivity of about 0.05. If you place your hand within an inch or two of a hot stove, you can feel heat on your hand. If you hold your hand an inch from a very hot pot, you will not feel much heat. This phenomenon could lead you to believe that the shiny chrome plating on the pot has a high R-value when in fact chromium, like most metals, is a good conductor of heat. Touching either the stove or the pot will result in a painful burn. The explanation lies in the emissivity - the inability of the shiny surface to emit infrared (heat) energy.

Heat transfer through bulk insulations (e.g. fibreglass, foam boards, etc.) is directly proportional to the difference in temperatures. On the other hand, as the temperature difference increases, radiation heat transfer increases dramatically. Radiant heat transfer is proportional to the difference in the fourth power of the absolute temperature difference (in effect, double the temperature difference and radiation increases by 16 times).

This is why low emissivity coatings will provide the greatest benefits where there are large differences in temperature, such as those encountered in industrial applications, for hot water tank and pipe insulation, or for ice arenas and cold storage facilities. In these applications, there are surfaces that are quite a bit hotter or colder than the adjacent interior or exterior.

Most building walls have an R-value of 12 to 20, so the interior surface temperature should be warm, and the temperature difference driving radiation is small. In these situations low emissivity coatings for the interior will not help much because the difference in temperature between the building surface and the surrounding environment is very small.

Windows experience greater temperature differences, so windows benefit from low-e coatings because of their low R-values.

In the case of low emissivity coatings on exterior walls, the insulation in the wall results in cooler exterior surface temperatures. Since the exterior wall temperature is similar to nearby surface and air temperatures, the radiant heat that can leave the wall during the heating season is reduced. However, in hot climates, light coloured, low-emissivity coatings on roof areas, as long as they are kept clean, will help reduce solar gains into the building because of the temperatures in the deep space the roof faces.

Low Emissivity vs. R-Value

Can a low emissivity surface reduce heat loss? In some cases, yes. Can it have an R-value? According to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 1997 Handbook of Fundamentals, it can. A vertical surface (i.e. a wall) with a surface emittance of 0.9 (typical of concrete, brick or wood) will have a metric RSI value of 0.12 (R= 0.68); with a surface emittance of 0.05, the RSI would be 0.30 (R=1.7). These surface R-values are in still air. Moving air (wind) reduces them substantially. The values are based on a surface-to-air temperature difference of 5.5°C, with the surface at 21°C. However, a typical 150 mm (6 inch) thick fibreglass batt has an RSI of 3.5 (R 20).

The normal interior "surface air film" that resists heat flow has a resistance of R0.68. Of this, about half is convective/conductive and half radiation. Even if the low-e coat reduced radiant heat flow to zero, it would only double the R-value of the film - to R1.4. An R0.7 gain for a wall with an R12 or R20 is not that significant.

We know of no paint that has an emittance as low as 0.05.

The Results of Product Testing

Manufacturers of low emissivity coatings or "insulating paint" have had their products tested by respected testing agencies, but none of the tests were standard ASTM (American Society for Testing and Materials) tests. Manufacturers appear to have invented their own test procedures that provide favourable results. Not following the accepted testing standards casts doubt on the R-value claims made for these products. ASTM has two accepted

test procedures for determining the thermal resistance of materials - the calibrated hot box (C 976) and the guarded hot box (C 236) tests.

Most tests to which the radiant coatings are subjected do not test the amount of steady-state energy (heat) loss, but simply the temperatures in a test box at intervals of one minute, up to a maximum of five minutes. This is rather meaningless. Standard R-value testing is done over a much longer time period.

Other tests are done on containers or buildings where it is desired to keep heat out. In those applications, the products do perform well at keeping heat out in summer. That is why in the southern US, where cooling is a major concern, reflective finishes are actually being encouraged. There is no data on how these paints perform at keeping heat *in* during a Canadian winter.

The reflective properties of "low-emissivity" or "reflective" paints may contribute to a slight improvement in comfort. The paints may have superior stretchability, bridging properties and adhesion to various substrates. They may be tough and resist abrasion during cleaning. They may be more or less permeable. However, giving them a high R-value is pushing it. ☼

Letter to the Editor

Re: Bubble Pack Foil Coated Insulation (Solplan Review No. 103, March 2002)

We are very disappointed with the article in the March 2002 issue. It is very misleading and damaging to our industry.

You say, "Reflective insulation is NOT intended to be used as insulation under concrete floor slabs." There are no source or study reports mentioned in your article. I think it is important to state your sources when making a strong statement like that. There are serious companies promoting reflective insulation in general and the underslab application in particular. All these companies have solid test data and a lot of experience with monitoring the results of the installation of their products.

You also state, "Complainants of high heating bills have been received from homeowners with in-floor radiant heat in their basement." As a manufacturer, we have not received a single complaint on such matter in the last 5 years. If you did receive several complaints, please send me the names, addresses and phone numbers of these people. As a responsible manufacturer, we will contact them right away to help them solve their problems.

The article also states that the only valuable application for reflective insulation is the one defined in CCMC report #12342-R. Again misleading. There are many other applications for walls, ceilings, roofs and floors in all types of construction that are just as efficient and as good.

I think that your article is not written on strong foundations and is damaging to our industry. There are companies working really hard to promote innovative and good products such as reflective insulation. That type of article with no sources, names or test data is an incredible drawback to the growth of our industry.

Patrick Gaudreault
Polly-Tech Radiant Inc.
Beauport, Quebec

Bubble pack foil products may provide a good and robust moisture barrier when used under the slab. However, we have not seen any independent test reports done in accordance with accepted engineering practices to justify the insulation properties claimed for reflective insulation when used under concrete floor slabs on grade. Bubble pack products, if used under concrete slabs and provided the bubble encapsulating the foil remains intact, may offer an R-value of R-1.2 to 2. This is much less than is required to provide effective insulation to keep the heat in. In BC, the building code minimum is for R-12 under heated floor slabs.

It is also worth noting that should the protective plastic be damaged, chemical interaction between concrete and aluminum foil will corrode the aluminum.

The only application of low emissivity insulation products that has been evaluated is that covered by the CCMC report, which applies to a wall application.

Reflective insulation products are effective at reflecting back the heat radiating across an air space as long as they can remain clean and dust free. The sheet itself is not an adequate insulation. Reflective insulation products in attic spaces have been found to be effective in the southern US. In those climates, dominated by cooling loads, they can reduce summer overheating. However they do not have any significant impact on winter heating loads.

In wall spaces, reflective insulation applied with properly compartmented air spaces can contribute to an effective insulation system. However, the surface must be carefully air sealed, otherwise the convection currents in air spaces can move a lot of heat around the sheet. Ed.

Test Standards for Prehung Entry Doors

Exterior doors are currently tested to either the CGSB-82.5-M88 or CSA A440 standard. Both are about to be replaced by a new North American Harmonized Door standard.

While perhaps providing minimum standards, CGSB-82.5-M88 and CSA A440 do not address concerns relative to water penetration and the resulting moisture problems and rot within the building envelope. As a result, the Window and Door Manufacturers Association of BC (WDMA-BC), in part spurred on by recent legislative changes in BC concerning mandatory building envelope warranties, has decided to pursue the creation of a more substantial and comprehensive door testing standard.

WDMA-BC hopes to create a superior door standard that will better suit the needs of the British Columbia construction industry and may eventually be recognized by the CWDMA, CSA and the National Building Code as a companion document to whatever standards are then in effect.

Other work also being pursued is an investigation of the impact of changes in building technology, such as:

- the effect reduced overhangs have on building envelopes (with specific regard to entry doors);
- the impact of pressure differentials on water infiltration;
- how sill pans, flashing, peel-and-stick membranes, and other ways of sealing the door to the framed opening prevent water infiltration; and
- how energy efficiency impacts solar heat gain (cost vs. benefits in coastal climates).

The goal is to develop a Best Practice Guide for the door industry.

In undertaking the project, the industry has set itself an impressive target. It plans to review first principles to determine to what standard doors should be tested. Questions being asked include:

What should be expected from an entry door? Should it leak air? Water? How much? Under what conditions? Should the door be tested with a pressure differential? If so, how much? Should forced entry resistance be a test criteria? ☼

Information
Window and Door Manufacturers Association of BC
e-mail: info@wdma-bc.org
www.wdma-bc.org

Johns Manville Launches a Formaldehyde-Free Line of Fibreglass Building Insulation

Johns Manville Corporation has announced that it will begin producing a formaldehyde-free line of fibreglass building insulation. Formaldehyde-based resins have traditionally been used as a binder (glue) in all fibreglass insulation products. Glass fibres are sprayed with a phenol-formaldehyde binder and then cured in an oven.

The new formaldehyde-free line will use an acrylic resin as its binder. The new binder will eliminate any concerns about fibreglass insulation being a potential source of formaldehyde in the indoor environment. The conversion will also eliminate formaldehyde emissions during manufacturing. Conventional fibreglass products are yellow in colour after the phenol/formaldehyde-based binders are oven-cured. Some manufacturers dye their products to give them a unique look. The new line of fibreglass is naturally white in colour.

The Johns Manville move is being made in response to market perceptions about the use of products containing formaldehyde for interior use. Shipment of the new formaldehyde-free line began in March 2002 in the United States, with all building insulation manufacturing facilities in the United States and Canada to be converted to formaldehyde-free binder production by August 2002. ☼

Determining Heating System Size

Heating system performance is a consistent and major source of homeowner complaints.

The purpose of a heating system is to provide the thermal comfort needed to supplement what nature and the building envelope can provide. Today, a wide range of sophisticated equipment is available to condition our homes. Unfortunately, we have not kept pace with the knowledge needed to put this equipment to its best use.

In the past, heating systems were simpler, less efficient, less effective, and less sophisticated. At the same time, homeowner expectations were much lower. Many homes had poorly distributed heat, and many owners kept only portions of their house warm. In winter, people had winter clothing for indoors. Today, we want to wear a T-shirt and go barefoot in the house year round. There is a reason why granny knitted wool socks and sweaters, and why down comforters and heavy woollens were made.

Our expectations today are much more demanding. Perhaps it is the mid-winter vacations to tropical regions many take that have created the desire to create such conditions at home, regardless of the weather outside.

For a long time houses were built uniformly, similar in terms of construction detail, design and size, so most houses had fairly uniform heating needs. This meant that much of the heating system design could be achieved by using rules of thumb learned on the job. There may have been some system design undertaken, but it was rudimentary. This in spite of the fact that the building code has had a requirement for heating systems to be sized in accordance with CSA Standard F280 (*Determining the Required Capacity of Residential Space Heating and Cooling Appliances*). However, this is a requirement that is rarely enforced, and fewer still understand the contents of the standard, let alone have seen a copy of the document. It is telling that I had difficulty accessing a copy of the CSA F280 for review because even local utilities did not have it in their possession.

In practice, it is not necessary to have a copy of the document, as long as one understands its content. CSA F280 provides a detailed methodology for calculating a home's heat loss. The fundamental feature is that it is a room-by-room heat loss and not a total building heat loss calculation which is the most common method many use, and which is calculated by HOT-2000. (The next version of HOT-2000, currently being developed, will include the capacity to do room-by-room heat loss calculations).

CSA F280 requires calculations be done with an indoor heating season design condition of 22°C for living spaces, and 18°C in unfinished basements. Outdoor design conditions are listed in the standard, but are essentially the January 2 ½% weather data in the climatic summary that appears in the building code.

The R-value used for each envelope component must be the actual, not nominal, R-value. This is consistent with building envelope calculations that are presently built into HOT-2000. The total heat loss for each room above grade is calculated by adding the heat loss of each component. The air change heat loss is based on average air tightness assumptions, which have not been updated for some time.

For below-grade elements, heat loss factors have been calculated for a wide range of construction assemblies, and the data is provided in tables.

The standard makes it clear that the total heating system capacity should not exceed 140% of design capacity. An exception is made for oil-fired appliances and solid fuel fired equipment, since there are limits on the size of available equipment.

CSA F280 is a standard that lays out the procedures for calculating the size of a required heating system. In this age of computers, it is unlikely anyone will willingly follow the longhand calculation, which is simply too cumbersome and prone to error. Rather, the F280 standard is most likely to be used by software developers, engineers, and administrators who may need to determine the appropriate characteristics that need to be considered or used. Most users today will rely on software. Several packages are now available on the market, although all may not be 100% compliant with CSA F280. However, any software that relies on accepted engineering standards in its formulas should provide acceptable results if it uses the correct design assumptions, including actual R-values. ☼

R-2000

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000 www.R-2000.ca

CSA F280: Determining the Required Capacity of Residential Space Heating and Cooling Appliances. *Available from CSA International. Tel: 1-800-463-6727 or 1-416-747-4044 www.csa-international.org*

Regulatory Reform: Australian Follow-up

We've reported in the past on the regulatory reforms that have been undertaken in Australia. CHBA, with the support of CMHC, have prepared an analysis and commentary on the Australian changes because they could serve as an example for us.

Wholesale changes come with their own challenges. Since there is much discussion in Canada today about reforms to regulatory structures affecting the construction industry, it is worth taking a look at the Australian experience after several years.

It seems that, in the haste to reform, a few too many corners may have been cut in Australia. Cases are emerging of buildings that are built and certified, but which in fact are not code compliant. The shortcomings are not all minor code infractions, but serious breaches of fire safety codes. There are tales of faulty plumbing and electrical work, and acoustical problems. The problems are not associated only with small minor projects, but also with large luxury multi-family projects, including some high-profile signature projects.

As a news report stated, "in today's New South Wales, the person who installs your fire door is the person who issues the certificate to say that it has been installed correctly. The person who says that your new building complies with the national building code can be a private contractor who is being paid by the developer. And this can be the same person who certifies that the building has been built correctly."

The Australian system requires knowledgeable industry professionals, and a system that will ensure there is oversight, including professional ethics procedures with teeth. Where in the past only one major body handled building complaints, now there are a number of confusing and sometimes expensive agencies.

Responsibility for building standards is now spread across several government departments and relies to a great extent on private building surveyors who are accredited by an independent organization that may not be doing adequate enforcement of standards or performance. One of the big problems occurred because the laws did not stipulate what qualifications were needed for accreditation of certifiers.

Those factors might have contributed to the decline in building standards, but some observers claim that the biggest single reason has been the growing incapacity of public authorities to act as a proper watchdog. Local municipalities, it would appear, are often just the keepers of records supplied by private contractors. They don't always check new residential buildings themselves and they don't hear about problems until well after people move in.

As part of the reforms, building insurance, which was handled by public sector agencies, was privatized. It was thought that private insurers would force bad builders out of the industry. But the reality appears to have proved quite different, and two of the three major private insurers are now the subject of a royal commission. It seems that private insurance has proved so easy to get that builders were even being offered three months' free coverage. Regardless of their past track record, even the bad builders are being insured.

Significant changes are being proposed to make sure the skills and competencies are appropriate, and that certifiers are appropriately assessed.

We hope that any regulatory reform in Canada will accept the lessons learned in Australia so that we don't repeat their mistakes. ✪

Preventing Water Migration into Concrete Footings

Conventional practice for the preparation of concrete footings calls for pouring the concrete directly in contact with the ground. This practice allows the concrete to continuously absorb ground moisture, thereby contributing to a building's moisture load, a special concern in areas where soils are wet or the climate is moist. Fastfoot Lite is a new product from Fastfoot Industries Ltd. that provides a capillary break between the ground and the concrete footing, thereby reducing the amount of ground water that enters at the base of the footing.

Fastfoot Industries Ltd. develops and markets patented fabric forming systems for concrete footings, pads and walls. These products offer significant economic and environmental advantages compared to conventional forms.

For information
Fastfoot Industries Ltd.
www.fastfoot.com
Tel: 1-888-303-3278

Technical Research Committee News

Canadian Home Builders' Association

Moisture in Exterior Walls

A consortium of agencies and corporations led by the Institute for Research in Construction has been examining moisture in walls for the past several years to better understand the problems being encountered in the field. The project has been studying how moisture enters the building envelope, including vapour diffusion, air movement, rain penetration and seepage. This has been done through many laboratory tests as well as theoretical analysis. The focus has been on wood frame buildings with rain penetration control strategies based on rain-screen principles. The intent is to develop guidelines for moisture management strategies in walls that will offer solutions for durable, long-lasting walls suitable for the wide range of climate zones across North America.

Information is now being analysed, and will be published later this year. Already a moisture climate zone classification for Canada has been prepared and will be incorporated in the next edition of the National Building Code. As well, a material properties' database is being developed, to make it easier to assess alternate materials.

IRC's Building Science Insight seminar series next year, which is offered across the country, will present findings of this project.

Arc Fault Circuit Interrupters

The Canadian Electrical Code was recently changed to add a requirement for arc fault circuit interrupters in bedrooms. This adds a cost of around $150. The reasons for the change, nor the impact was made clear to CHBA.

This change has highlighted the need to improve the electrical code review process, in particular the process for making changes. At present, the electrical code is developed by CSA. The process does not involve adequate consultation or cost analysis with all affected sectors in the industry, so changes in standards that could affect many can be made with minimal input.

CSA standards are developed on a consensus basis by a committee that represents primarily industry participants. When a standard goes out for review, a notice of intent or notice of public review is published, but it is not always widely disseminated to all affected parties. Unlike the building code development process, CSA does not necessarily contact different organizations individually to let them know about proposed or possible changes. The review process is further restricted in that most participants are from central Canada, where all the meetings are held, so many that may be affected by the changes do not hear about them until it is too late to comment or influence the proceedings.

Sound Isolation and Fire Containment Details that Work: Building Insight Seminar Series 2002

This year the one day seminar organized by the Institute for Research in Construction National Research Council Canada will explain the fire resistance and sound transmission for typical wall and floor assemblies. The seminar will include presentations on Airborne Sound transmission through walls and floors.

The walls and floors separating dwellings in multi-family buildings must serve many functions other than structural. To select assemblies, designers need ready access to collections of test ratings, but for successful installations they must appreciate how overall fire resistance and sound isolation may be compromised by the details in a complete building. The presentations and supporting materials at the seminar will deal with these practical issues.

Noise due to footsteps or other impacts. Simple floor coverings and resiliently supported floating floors reduce impact noise but the effectiveness depends on the base floor. A covering that reduces impact sound transmission through a concrete floor may have negligible benefit on a joist floor. Optimum designs for different types of floors will be discussed.

Fire resistance of wall and floor assemblies. Fire resistance depends on the materials and how they are assembled, but the physics of fire depends on different properties of the materials and their assembly from those that control sound. Recent studies on the effect of changing specific components of framed wall and floor assemblies will be summarised, along with some design recommendations.

Ratings for wall and floor systems. An overview of the expanded tables in Part 9 of the National Building Code will be presented, together with a demonstration of simple software tools to facilitate access to that information.

The seminars will take place September to November across Canada.

For more information, check the IRC web site (*www.nrc.ca*) or IRC Client Services:

phone: (613) 993-043
fax: (613) 952-7673

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

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Mould Claims Litigation

In the last several years - fuelled by large jury verdicts and intense media attention - mould has taken centre stage in US construction defect litigation. American newspapers and television stations are reporting daily on new mould claims. Mould litigation has arrived.

Perhaps it is the litigious nature of the American legal system that has raised the profile of mould. It may soon happen here in Canada. To prepare for it, you must develop a protocol for claims handling and litigation.

There is no doubt that moulds can make people sick and must be kept in check. Health officials are studying the medical issues and legislators are attempting to create standards.

Mould spores are present everywhere. Mould has existed for millions of years. Where moisture and a food source exist, mould is likely to be found. Where there are conditions suited for mould growth, it will take place.

It is important to recognize that homes offer the perfect environment for mould growth because the space is kept warm and there is constant moisture generated by occupants and their activities.

Where poor construction practices result in leaks, there is a good chance mould growth can take place.

The obvious first step to minimize mould problems is to ensure that construction is compliant with all codes and good building practice. If a mould problem does arise, there are a number of steps you can take in advance to minimize your potential liability.

What is most important, you can reduce your potential liability by building homes that manage water and moisture effectively. You can also minimize potential liability by educating the homeowner and making sure that he or she knows that proper maintenance is important to moisture control and prevention. Where homeowners fail to maintain their premises correctly, moisture problems can occur.

In addition to building a home that manages water and moisture effectively, you should always document your efforts to do so.

Mould growth occurs in the presence of:

- *Moisture*
- *Nutrients*
- *Mould spores*
- *Temperature*

The only factor that can be controlled is moisture. If the home is kept dry, mould will not grow.

Pre-Litigation Issues: Responding to Homeowners and Investigating Claims

Homeowners will often call to report a leak or moisture problem. Because moisture is the key to mould growth, all such calls should be taken seriously and dealt with promptly. Sloppy investigation of a mould claim and improper clean-up of mould contamination can make the situation worse.

The first step in any remediation plan is to identify and repair the moisture source. If you fail to do so, mould will either grow or continue to grow.

Remove all standing water, accelerate the drying process, and discard and replace all porous materials that cannot be dried quickly and completely (like insulation, ceiling tiles and wallboard).

If a homeowner complains about water damage, you should immediately find out when the damage occurred. If building materials get wet, it typically takes 24 to 48 hours before mould begins to grow. If this 24 to 48 hour time period has not yet elapsed, you probably can prevent mould growth.

After your initial investigation, you should consider whether the claim could be resolved on favourable terms. It is often less expensive to resolve a claim than fight it out.

If the water is contaminated with sewage or other pollutants, you should consult a professional remediation firm.

Keep Detailed Documentation

Investigation and remediation must take place quickly. Nevertheless, it is critical that relevant evidence is preserved in the event that a lawsuit is filed. Accordingly, if inspections are done, all findings should be written down in detail and photographs taken. If remediation takes place, the remediation process should be well documented and photographs and videotape should be taken before, during and after remediation to show exactly what was done.

A multi-disciplinary approach is necessary to defend against mould claims. In conducting a building investigation, you are looking for construction defects, building product defects, design defects and other sources of moisture. ✪

A Builder's Guide to Handling Mould Claims and Litigation Prepared by the National Association of Home Builders with assistance from McCarter & English, LLP.

eKOCOMFORT™: Advanced Integrated Mechanical Systems

With the lower energy loads in energy efficient homes, new approaches for the design of mechanical systems make sense. Increasingly, mechanical installers are combining space heating and domestic hot water systems. Some manufacturers are beginning to offer packaged systems.

A new initiative, which had its birth in the Advanced Houses program of the early 1990s, is leading to complete systems that tackle space heating, cooling, domestic hot water and ventilation in a single package. Six manufacturing groups in various parts of Canada are presently developing the new packages. eKOCOMFORT™ is the trademarked name for these advanced integrated mechanical systems.

eKOCOMFORT™ systems are a practical, cost-effective way to help fulfill the objectives of the Kyoto Protocol. They provide heating, cooling and ventilation at high rates of efficiency to the residential and small the apartment unit for both new construction and for the conversion market where space is at a premium and displaced electricity is provided by fossil fuel burning generators.

eKOCOMFORT™ systems feature advanced circulating fan control, motor and strategy which significantly reduces electrical consumption. Efficient electronic commutating motors allow the fan speed to match heat output with heat requirements, reducing electrical consumption by ensuring fan operation at a lower level when the demand for heat is lower. Circulating fans are strategically located so that only one motor is needed to provide air circulation, heat recovery ventilation, supply of combustion air and expulsion of combustion products.

Laboratory testing has been done, and trials at the Canadian Centre for Housing Technology have been completed for several units. Trial runs of prototype units are about to be made by at least two manufacturers who have completed prototypes, and expect to have their first production models later this year.

The first series of production units will be placed into occupied homes where units will be tested further under in-service conditions. This will be made through an Innovative Builder program, where the manufacturers will make special arrangements to ensure that there will be service and monitoring of the units for at least the first three years in operation. This will ensure that the homeowners will be well looked after during the period and to reduce the risks associated with any uncertainty associated with new and untried products. ✪

For more information: www.ekocomfort.com

Are You a Net Energy Producer?

Wind, photovoltaics and micro hydro could be the most accessible and cost-effective way for individuals and businesses to become small-scale independent power producers (IPPs) in Canada. This is based on the success of 'distributed energy systems' in Europe and Japan and parts of the US that incorporate small-scale renewable energy installations in their overall generation mix.

Building on the study carried out for CMHC on the energy use patterns in off-grid houses (Solplan Review No. 103, March 2002), Shawna Henderson of **abri sustainable design and consulting**, is studying the experience of early adopters of small-scale, renewable energy source grid-connected systems and net metering policy in Canada. The study will look at the reasons why people decide to become a small-scale power producer using renewable energy sources and the obstacles or challenges to widespread acceptance of the technology.

The systems to be included in this study will be limited to what a homeowner or small to medium business could expect to invest in cost-effectively, and include: PV up to 10kW, Wind 10 to 100 kW, and Micro hydro up to 100 kW.

These systems carry some or all, of the electrical load of a building (or buildings), using the grid as a backup/storage system, instead of the batteries used in off-grid, or stand-alone, installations. Because the battery bank is expensive for off-grid systems, the reduced cost of a grid-connected renewable energy system makes the payback period shorter.

In some cases, the system may be large enough, that it produces more energy than it uses. Where a net metering policy is in place, the utility pays or credits you for the excess energy. With an energy-producing building, the payback is even shorter because there is a further economic return on the energy being produced. The presence – or absence – of a clear policy on grid-connection and net metering is the major factor to the development of a strong independent power sector, so the study will also view the net metering policies across Canada.

For more information on this project, or to be included in the survey, contact Shawna Henderson
email: shawna@AbriDesign.com,
Phone 1.902.757.0909
or toll-free: 1.866.649.5318
Fx: 1.902.757.3364

Energy Answers

Rob Dumont

What is the operating principle of a condensing furnace?

In essence, the condensing furnace has larger heat exchange surfaces that can extract more energy from the combustion gases. Because of the acids present in the combustion gases, a secondary heat exchanger made of stainless steel or other corrosion resistant material is usually used in condensing furnaces. A cross-section of a condensing furnace is shown in the accompanying diagram. By condensing the flue gases, the heat of condensation is recovered inside the furnace and made available to the warm air on the other side of the heat exchanger.

Another major advantage of the condensing furnace is the absence of a chimney. During the off-cycles, there is little or no venting of house air up the chimney as is the case with the older natural draft vented chimneys. A third advantage is the absence of a pilot light.

How much of an improvement in efficiency can you expect by installing a condensing furnace?

A 1989 study done in Manitoba by Cam MacInnis of Unies Ltd. found that the space heating consumption of a house that had a standard atmospherically vented furnace replaced with a condensing furnace would reduce its energy consumption by an average of 34%. The range varied from a high of 50% to a low of 19%. Atmospheric vented furnaces generally have seasonal efficiencies in the range of only about 55% to 65%, while most condensing furnaces are in the range of 90 to 96%.

How acidic is the condensate from a condensing furnace, and is the condensate a concern?

The condensate does contain some weak acids, and I would not recommend anyone trying to drink the liquid. However, the condensate can be drained down the regular house plumbing into the sewer.

Condensing furnaces look more complicated than the older furnaces. Don't the condensing furnaces require more maintenance?

It's true that the older furnaces were very simple and also very reliable. Natural gas was first installed in Saskatoon about 1952, and we have some atmospheric vented furnaces from that era that are still running. By contrast, the condensing furnaces have electronic ignition, more electronics and an induced draft exhaust fan, all of which add to complexity and make the furnaces more maintenance-prone. Whether the condensing furnaces will see 50 years of service is a moot point.

A recent study by Consumer Reports, however, found that condensing furnaces had a higher reliability record than mid-efficiency furnaces.

What are some common maintenance problems?

Here are four problems that an experienced furnace installer brought to my attention.

In certain high humidity weather conditions with hoar frost outdoors, the outside air intake for the furnace can get plugged with frost, and the safety systems will shut down the furnace. The remedy is rather simple with most furnaces. Clean off the hoar frost on the intake, and the problem is solved.

A second problem is the buildup of oxidation on the flame sensing probe elements. This problem can be remedied by using a fine sandpaper to periodically clean off the flame sensing probe.

A third problem is the cracking of the hot surface ignitor. The ceramic material used only has a limited life, and the more cycles that the furnace experiences, the earlier the ceramic will fail. One way to prolong the life of the hot surface ignitor is to make certain that the furnace is properly sized for the house load. Oversized furnaces tend to cycle on and off more than properly sized units. A related problem is thermostats that have too narrow a dead band for temperature. With a narrow dead band thermostat, the furnaces cycle on and off more frequently. An experienced local furnace installer is now using the HUNTER Set and Save 110 brand thermostat, which is one of the very few on the market that has an adjustable dead band. A wider dead band will help reduce furnace cycling, and also will heat rooms that are far from the furnace.

A fourth problem with some condensing furnaces is the buildup of lint and dust on the cross-lighter, which will prevent all of the gas burners from lighting and, as a consequence, shut down the furnace. Periodic cleaning of the burners can help with this problem.

Why were there heat exchanger problems with the early condensing furnaces?

Certain types of stainless steel are prone to attack from chloride compounds. A number of the early condensing furnaces drew the combustion air from inside the house, and the air inside houses often has chloride compounds which can attack the stainless steel. Newer condensing furnaces mostly tend to draw the combustion air from outdoors, and outdoor air generally has fewer chlorides. In addition, more corrosion resistant stainless steels or alternative materials are now being used in the heat exchangers of the condensing furnaces.

Are there any particular points to watch when replacing an older furnace?

Condensing furnaces have considerably higher warm air flows than older furnaces of the same input capacity. Let me repeat. CONDENSING FURNACES HAVE CONSIDERABLY HIGHER WARM AIRFLOWS THAN OLDER FURNACES OF THE SAME INPUT CAPACITY. Older furnaces tend to have warm air temperature rise values of about 70oF to 100oF (39oC to 56oC). Newer condensing furnaces have warm air temperature rise values of only about 40oF to 70oF (22oC to 40oC). To compensate for the lower temperature rise, the condensing furnaces must have a higher air flow for the same BTU/hour input capacity.

You cannot replace an older 100,000 BTU/hour furnace with a new 100,000 BTU/hour condensing furnace. The ductwork on the old furnace is almost always too small for the new furnace. Fortunately, however, most older furnaces are generously oversized for the loads, and you can downsize the new furnace in most instances. An experienced service person can look at the historic energy consumption pattern of the house using the past bills, and recommend a more appropriately down-sized furnace. Unless the older furnace was unable to heat the house, you should always down-size the new furnace. In many cases, down-sizing of at least 40% is quite appropriate.

Another point to consider is the electrical consumption of the fans in the furnace. A smaller furnace will run more hours than a larger furnace, and one way to minimize the electrical consumption of the furnace is to choose a furnace with high efficiency motors. We recently tested a new 105,000 Btu/hr (31 kW) condensing furnace that had a 3/4 horsepower motor. The electrical draw was more than 800 watts with both the furnace fan and the induced draft exhaust fan running. Most older furnaces used only a 1/4 or 1/3 hp motor with electric power consumption in the range of 300 to 500 watts. Several furnace manufacturers offer brushless direct current motors as an option, and these motors are preferred, as they are considerably more energy efficient than the standard motors.

As with many things in life, better costs more initially, but will save money year after year. A wise observer of the human condition once noted that "the bitter taste of poor quality lasts much longer than the initial sweetness of a low price."

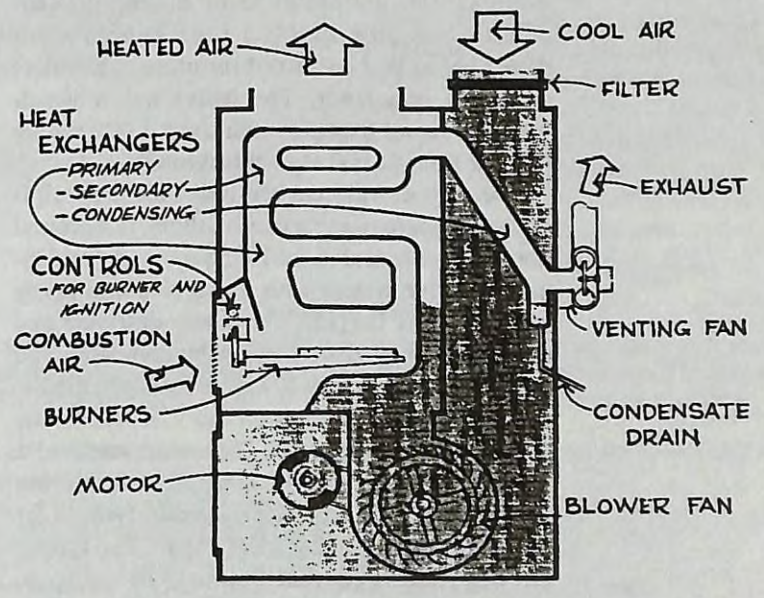

Figure 1. Cross-section of a Condensing Furnace
Credit: Furnace Selection Booklet, Alberta Energy & Natural Resources

NRC·CNRC

Research: Sprinklers - Burnt Offerings

Kemano, a deserted town in remote British Columbia, provided the ideal ground for testing a sprinkler's ability to put out house fires.

By Joseph Z.Su, George P. Crampton, Don W. Carpenter, Cameron McCartney

Kemano, was a company town built 50 years ago by Alcan Smelters and Chemicals to support its hydroelectric station on the remote north coast of BC. When the station was automated, making the town obsolete, an idea was born. The deserted town was donated to B.CB.C's Office of the Fire Commissioner for training and research. This has been known as the Kemano Public Safety Initiative.

As part of this unique opportunity, the National Research Council of Canada was invited to conduct a series of full-scale fire experiments at the town. One series of experiments was designed to evaluate the performance of a cross-linked-polyethylene pipe sprinkler system in an abandoned house that contained furniture to simulate a normal occupancy. The house was a wood-framed bi-level structure with about 1,000 square feet per floor (2,000 square feet total).

The sprinkler system was tested for fires originating in a basement recreation room, in a ground floor bedroom, and in the living room. A residential sprinkler system with quick response heads (rated at 68.3°C ([155°F))]) was designed and installed by a residential sprinkler company. The designed flow rate was 50 L/min for the hydraulically remotest sprinkler head and 55 L/min for the hydraulically nearest one. The system was under a static pressure of 552 kPa (80 psi); during sprinkler activation, the main manifold was under a flowing pressure of 241 kPa (35 psi). The system was designed to prevent flashover in the room where fire originated and to allow response time for the fire department.

In all experiments, a single sprinkler head controlled and contained the fire within the original room within one minute of activation. The water spray cooled down the fire compartment. Since the fire was successfully controlled in each experiment, the fire damage was limited to the furniture that was near the ignition source. There was soot deposition as expected, but no structural damage. For experiments with the fire room door closed, temperature and visibility along the egress route were basically not affected by the fire inside that room.

In the recreation room the plastic pipes and fittings were installed without protection, on open wood joists. The equipment was exposed to temperatures as high as 140°C in two experiments. After exposure to temperatures above their rated temperature of 93°C (200°F) at 552 kPa (80 psi) for 140 seconds, the pipes and fittings were not visibly damaged, and the sprinkler system was then successfully actuated and controlled the fire.

The effectiveness of heat and smoke detectors was also investigated in the sprinkler experiments. As expected, the heat detectors, which were rated at 57°C (135°F) and a temperature rise of 8.4°C/min (15°F/min), were always actuated earlier than the sprinkler. The rate of temperature rise triggered the heat detectors. Smoke detectors, installed on the egress route, were actuated before the sprinkler when the fire room was open to the egress route but after the sprinkler when the fire room door was closed.

Technical data obtained from the Kemano experiments can be used as a basis for further studies on sprinkler systems. Questions can be directed to Dr. Joseph Su at (613) 993-9616, fax (613) 954-0483, or e-mail joseph.su@nrc.ca.

Dr. Joseph Su is a researcher in the Fire Risk Management Program of the National Research Council's Institute for Research in Construction in Ottawa. George P. Crampton, Don W. Carpenter, Cameron McCartney, and Patrice Leroux are technical officers in the same program.

(Editor's note: this article was first published in Canadian Consulting Engineer, May 2002. Reproduced with permission.)

National Research Council Canada · Conseil national de recherches Canada

Green Building Resource

Environmental Building News has released an updated version of their EBN Archives CD-ROM. This is a fully searchable CD that includes all back issues of Environmental Building News exactly as they appeared in print - from 1992 through the end of 2001. Also included is EBN's updated bibliography of the best information resources on green building. Although most are US based, they have good coverage of Canadian resources.

Product reviews mentioned in the EBN Archives include links to an online database of current manufacturer contact information. A word of caution needs to be made here - the links only work if you use Microsoft Explorer as their web browser. They do not seem to match with Netscape.

Environmental Building News includes in-depth articles on a wide range of topics related to sustainable building-from renewable energy and recycled-content materials to land-use planning and indoor air quality.

The EBN Archives are US $149 (US $95 for EBN subscribers).

For more information
www.BuildingGreen.com
Tel: 1-800-861-0954.

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